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ABSTRACT

This document contains four papers from a symposium on transfer of learning. "Factors Affecting Transfer of Training in an Industrial Setting" (Reid A. Bates, Elwood F. Holton III, Dian L. Seyler) identified seven transfer climate variables that predicted performance and three interpersonal variables that predicted performance ratings. Results reported in "Development and Validation of a Generalized Learning Transfer Climate Questionnaire: A Preliminary Report" (Elwood F. Holton III, Reid A. Bates, Michael Leimbach) support all but one construct of the Learning Transfer Questionnaire. "Training Effects on Productivity and Work Quality after the Introduction of New Technologies in the Organization--An Exploratory Study" (Constantine J. Kontoghiorghes) concludes that a work environment adhering to sociotechnical principles facilitates training transfer and productivity and quality improvements. "Climate for Training Transfer: A Progress Review and Recommendations for Further Research" (Gary L. May, Barbara A. Reilly) updates a 1988 literature review to determine what research gaps still exist. (KC)

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14 Transfer of Learning

Chair: David Antonioni, University of Wisconsin-Madison

Factors Affecting Transfer of Training in an Industrial Setting
Reid A. Bates, Louisiana State University
Elwood F. Holton, III, Louisiana State University
Dian L. Seyler, Louisiana State University

Training Effects on Productivity and Work Quality After the Introduction of New Technologies in the Organization - an Exploratory Study
Constantine J. Kontoghiorghes, Georgia State University

Climate for Training Transfer: A Progress Review and Recommendations for Further Research
Gary L. May, Millbrook Distribution Services, AHRD Global 100 member
Barbara A. Reilly, Georgia State University

Development and Validation of a Generalized Learning Transfer Climate Questionnaire: A Preliminary Report
Elwood F. Holton, III, Louisiana State University
Reid A. Bates, Louisiana State University
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Factors Affecting Transfer of Training in an Industrial Setting

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This study defined and developed measures and tested the impact of a number of transfer of training variables on the performance ratings of operators in a large petrochemical manufacturing facility. Results of a hierarchical regression showed that a set of seven transfer climate variables were the largest contributors to the prediction of performance. Training content validity and three interpersonal transfer climate variables (peer support, change resistance, and supervisor sanctions) emerged as significant predictors of performance ratings. The findings suggest the value of comprehensive, integrated models and partially validate one such theoretical model.

The present level of knowledge with regard to the dynamics of the training transfer process is limited. Research examining the role of work environment factors in training transfer was virtually non-existent prior to 1980. Since that time the importance of situational constraints/facilitators such as appropriate tools and equipment or job-related information has been fairly well established (Kozlowski & Hults, 1987; Peters, O'Connor, & Eulberg, 1985). Considerably less is known about the role of transfer climate despite the presence of these variables in nearly all training environments.

A comprehensive review of research literature pertaining to training transfer (Bates, 1997) revealed several core areas in which transfer research is still deficient. First, despite increasing research directed at a range of factors affecting transfer, critical dimensions of the transfer equation have not yet been adequately defined. For example, overlooked areas include: training content validity (Salomon & Perkins, 1989); job attitudes such as job involvement (Noe & Schmitt, 1986) and organizational commitment (Larson & Fukami, 1984); and pre-training motivation (Baldwin, Magjuka, & Loher, 1991; Tannenbaum et al., 1991).

Second, a number of researchers have recognized the necessity of building comprehensive, integrated models of the training process in order to fully understand and reliably identify the causes and effects of training success or failure (Holton, 1996; Rouiller & Goldstein, 1993; Tracy, Tannenbaum, & Kavanaugh, 1995; Xiao, 1996). Unfortunately, very limited research has been done with these models and none have been validated by further research. Thus, transfer research lacks an accepted theoretical framework for evaluating these factors together in context.

Third, transfer constructs must be made validly and reliably measurable. The tendency toward custom designed scales for each study typical of much of the transfer research makes generalization of findings across studies questionable and conclusions about the latent construct structure of important transfer of training variables difficult. Some of the scales used in previous research, particularly single item measures, also have questionable psychometric qualities. Not surprisingly, studies in which such measures have been used often yielded different conclusions about predictor-outcome relationships than had previously been found.

The purpose of this study was to investigate factors affecting transfer of computer-based training in an industrial setting. More specifically, it addressed missing elements in previous research by investigating the role of transfer of training climate and specific training design variables, job attitudes, and motivational elements in the transfer of training process. The study provides a partial test of a theoretical model of training effectiveness in an attempt to measure and explain training transfer. Accepted scale development procedures, including factor analysis, were used in an effort to develop more valid and reliable scales of the constructs of interest.

Eleven specific hypotheses were investigated to address two general research questions (shortened here for space reasons):

Research Question 1: What are the correlations between the independent transfer variables, and between the independent and dependent transfer variables in this study?

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Research Question 2: What proportion of the variance in performance is explained by five sets of these variables?

Theoretical Background for the Study

The conceptual model framing data analysis in this study (see Figure 1) was drawn from the integrated evaluation research and measurement model proposed by Holton (1996). This model was developed by examining relationships and constructs from previous empirical research and integrating the findings into a theoretical framework proposed by Noe (1986) and consistent with Baldwin and Ford's (1988) transfer process model. Holton's model described an individual's training related behavior as a function of ability/enabling elements (e.g., ability, transfer design), environmental elements (e.g., reaction to training, transfer climate, external events), motivational elements (e.g., motivation to learn or transfer, expected return on investment), and secondary influences such as job attitudes or personality characteristics. A specific subset of the elements suggested by Holton's model was examined in this study with the addition of a training design variable (content validity).

As shown in Figure 1, 12 independent variables were examined. These variables included an ability/enabling element, transfer design, a construct which reflects the degree to which transfer mechanisms are a part of the training design. Environmental elements were represented by a transfer climate construct which contained seven variables, four positive climate variables (supervisory support, opportunity to use, peer support, and positive personal outcomes) and three negative climate variables (negative personal outcomes, change resistance, and supervisor sanctions). Secondary influences on training effectiveness included organizational commitment and training content validity. Motivational elements were represented by performance utility, a construct which measured two components of motivation to transfer, perceived utility and intent to use. Learning on computer-based exams (a training outcome variable) was also examined as an independent variable. The dependent variable in this study was supervisory ratings of operator performance.

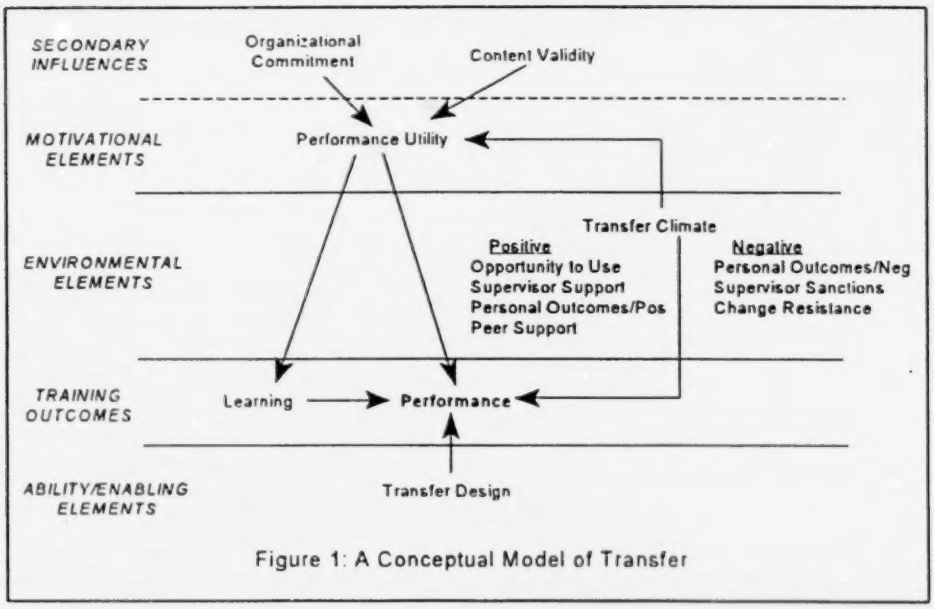

Figure 1: A Conceptual Model of Transfer

Method

This cross-sectional study was part of a bigger study undertaken to evaluate a large scale computer-based training system project, the Computer-Aided Training System (CATS) project. The goal of the CATS project was the implementation of a computer-based training (CBT) system designed to meet the training needs of a Fortune 500 size petrochemical producer in southern Louisiana.

Sample Subjects in this study were 73 production operators from two continuous production units involved in the manufacture of highly hazardous chemical products. Production operators in both units were responsible for monitoring, operating, and maintaining production related equipment such as reactors, filters, grinders, process analyzers, piping, valves, pressure gauges, flow meters, and a computerized process control board. Operators were required to undergo training and certification on 30 to over 100 training modules depending on their job responsibilities by May 15, 1995. Following the completion of training in May, 1995, the data collection instruments used in this study were administered.

Measures of Independent Variables Data were collected using a number of questionnaire instruments in addition to computer-based exam scores. The instruments used consisted of either established construct scales (e.g., organizational commitment) or new construct scales developed by the researchers. For all instruments, data from a larger sample of respondents were used to conduct exploratory common factor analyses in order to identify the latent construct structure for the population under study. Common factor analysis was used because it is considered more appropriate than principle component analysis when the objective is the identification of latent structures (Nunnally & Bernstein, 1994). Oblique rotation was employed in light of its suitability for latent variable investigation when latent variables may or may not be orthogonal (Hair, Anderson, Tatham, & Black, 1995). The initial criteria used to determine the number of factors to retain was an eigenvalue greater than or equal to one. However, when exploratory common factor analysis is used for theory building, the eigenvalue equal to one criteria for determining the number of factors to retain may not be completely correct. Unlike principal components analysis, the proportion of variance accounted for is not as important as identifying the latent structure of the data (Hair, et al., 1995). Therefore additional analyses were conducted to evaluate alternate structures with fewer and more factors retained. The most interpretable structure was then selected.

Measure of Dependent Variables The dependent variable used in this study was supervisory ratings of operator performance. This measure was based on supervisors' judgements of the percentage of time operators performed each procedure in a subset of approximately 20 critical procedures 100% correctly. Inadequate criterion measures has been identified as a weakness of transfer studies (Bates, 1997; May, 1997) so a complex seven-step development and implementation process was designed for this measure. Several factors underlie the use of this complex criterion measurement methodology. First, it was necessary to identify and use information relating to the performance of highly critical procedures because this information was of greatest value to the organization. Second, it was assumed that performance ratings of subordinates on procedures that the supervisors observed most frequently would be more accurate than ratings on procedures less frequently observed. Finally, the elaborate development process helped insure the content validity of the criterion measure.

The seven steps were:

1) Procedure Identification. A comprehensive of list of operating procedures is identified and collected for each production unit participating in the study.

2) Identification of Selection Criteria. Based on input from subject matter experts, three general selection criteria were used to identify critical procedures: (a) The procedure must be tied to an observable behavior; (b) the procedure must be performed either every 12 hour shift, every three day shift cycle, or at least once a month; and (c) the procedure must be critical to unit performance in terms of either safety, quality, or production rates.

3) Identification of Critical Procedures. A sample of approximately 50 highly critical procedures was selected and validated for each production unit and subunit. This process involved the use of an instrument asking supervisors to list the most critical procedures in their unit, identify

which criteria make the procedure critical (e.g., safety, quality, productivity), and to specify how frequently the procedure is used. The resulting lists were cross-checked and validated by subject matter experts.

4) Frequency Rating. The relative frequency with which supervisors were able to directly observe operator performance of each procedure on the critical procedures list was obtained using a questionnaire instrument. From each unit or sub-unit, the subset of procedures rated as the most frequently observed was determined by ranking the simple mean ratings of the frequency of observation of each procedure.

5) Final List of Critical Procedures. The 20 critical procedures with the highest mean ratings of observation frequency were chosen as the final subset of critical procedures for which performance ratings were collected.

6) Development of the Performance Rating Instrument. A performance rating instrument was developed to obtain supervisors' judgements of the percentage of time that operators performed each procedure in the set of critical procedures correctly. The instrument consisted of a five point Likert-type scale reflecting judgements about the percentage of time that supervisors observed procedures being performed correctly by individual operators. The scale ranged from (0) none of the time, (1) about 25% of the time, (2) about 50% of the time, (3) about 75% of the time, to (4) 100% of the time.

7) Performance Rating. Supervisors were given ten days to complete a performance rating instrument for each of their subordinates.

Analysis Bivariate correlation analysis was used to test predictions about expected associations between independent variables and between independent variables and the dependent variable.

Hierarchical regression analysis was used to examine how the variance in performance ratings was partitioned among predictors and to test predictions made about the ability of the independent variables to explain the variance in the criterion measure. Independent variables were entered in groups as shown in Table 1, based on the theoretical arrangement shown in Figure 1 (James & Brett, 1984). Although structural equation modeling provides a more powerful test, sample size limitations prevented us from using this methodology. Nevertheless, the current analyses constitutes a first step toward theory validation by simultaneously examining the effect of the variable sets on performance. While such an analysis is only suggestive of causal relationships, it builds a foundation for further research.

Findings

Research Question 1: Bivariate correlation analyses indicated that secondary influences on training effectiveness (organizational commitment and content validity) were positively correlated with performance utility. Variations in scale scores on seven transfer climate variables were associated with changes in performance utility in the expected directions. Scores on the opportunity to use, peer support, supervisor support, and positive personal outcomes scales were positively correlated with performance utility. Scores on the negative personal outcomes, change resistance, and supervisor sanctions scales were negatively correlated with performance utility. Learning from computer-based exams was not correlated with either performance utility or with performance ratings and was not a significant contributor to the explained variance in performance ratings.

Correlation analysis of the associations between predictor variables and performance ratings yielded mixed results. Of the predicted correlates of performance, only two transfer climate elements, peer support and supervisor sanctions, were significant with medium range correlations ($r = .24$, $p \leq .05$ and $r = .35$, $p \leq .01$ respectively).

Research Question 2: Hierarchical regression analysis results (see Table 1) indicated that:

1) Organizational commitment, entered first in the hierarchical regression, did not account for a significant proportion of the variance in performance ratings ($R^2 = .004$).

2) After the variance explained by organizational commitment is accounted for, content validity increased the proportion of explained variance to 6.3%. Although this increase approached

significance ($p \leq .06$) the model at this stage was not significant.

3) The addition of performance utility to the model increased explained variance .7%, a non-significant increase. The total variance explained by the model at this stage, with organizational commitment, content validity, and performance utility as predictors, reached 7% ($R^2 = .07$), also non-significant. However, with the addition of performance utility to the model, the Beta value for content validity became significant ($\beta = .32$, $p \leq .05$).

4) The entry of learning average into the regression model increased total variance explained by a non-significant 8.2%, also non-significant. The Beta value for content validity increased in significance at this stage ($\beta = .44$, $p \leq .05$) and remained significant throughout the remaining regression steps.

5) Transfer design increased total variance explained to 10%, a non-significant increase. Total model variance explained was still not significant.

6) When entered as a set, the seven transfer climate variables increased total variance explained by the model 36% ($p \leq .001$), producing a significant model ($F_{12,49} = 3.47$, $p \leq .001$) that explained 46% of the total variance in performance ratings. In the full model, significant Beta values were found for content validity, supervisor sanctions, peer support, and change resistance.

Table 1: Results of the Hierarchical Regression

Step	Variable(s) Entered	R^2 Adj R^2	$F_{\_\_}$ (df)	ΔR^2	$F_{\_\_}$ (df)	β"
1	Organizational Commitment	.004 -.013	.233 (1,60)	—	—	-.181
2'	Content Validity	.063 .032	1.99 (2,59)	.059	3.73 (1,62)	.443*
3'	Performance Utility	.07 .022	1.45 (3,58)	.007	.437 (1,58)	.034
4'	Learning Average	.082 .017	1.27 (4,57)	.012	.75 (1,57)	-.117
5'	Transfer Design	.10 .02	1.25 (5,56)	.018	1.13 (1,56)	-.055
6'	Supervisor Sanctions	.46 .327	3.47** (12,49)	.36	4.64** (7,49)	.387* .095
	Pos Pers Outcomes					.097
	Neg Pers Outcomes					.382*
	Change Resistance					.521*
	Peer Support					-.032
	Supervisor Support					-.211
	Opportunity to Use					

' Each successive model in the hierarchical regression analysis includes the variables previously entered.
" Beta values shown were calculated with all predictors entered in the regression equation.
* $p \leq .01$ ** $p \leq .001$

Conclusions and Discussion

The results of this study make a number of valuable contributions to an understanding of the transfer process. The following brief discussion, organized according to the three core shortcoming of transfer research identified earlier, highlights the most important of these contributions.

Training Transfer Variables First, the study points to several variables that are critical to the transfer process. Using a conceptualization of transfer climate in which climate dimensions were defined by their referent in the organization (see Holton, Bates, & Seyler, in press), this study suggests that transfer climate variables may be among the most powerful influences in the transfer process. In the present setting, interpersonal transfer climate dimensions including peer support,

group resistance to change, and supervisor sanctions were all highly significant predictors of performance ratings. The study also suggests that perceived training content validity can be an important force motivating the use of learned KSAs. The results of the hierarchical regression further imply that the relationship between content validity and training outcomes may not be totally mediated by motivational elements. That is, content validity may have a direct relationship with training outcomes by virtue of the inherent performance relevance of highly valid training content.

Transfer Climate As a set, the transfer climate variables were shown to account for a significant proportion ($R^2 = .36$, $p \leq .001$) of the variance in performance ratings. This finding corroborates other research which has shown transfer climate variables as a set to be the single largest contributors to the prediction of performance outcomes from training.

Although a good deal has been written suggesting the value of criterion referenced measures of organizational climate for understanding work behavior, few studies have used a climate construct to examine factors influencing training effectiveness. The present findings place this study alongside less than a handful of other studies (e.g., Rouiller & Goldstein, 1993; Tracy et al., 1995) which have operationalized a transfer climate measure and verified the importance of climate in training transfer. This study therefore makes an important contribution to the growing recognition that specific attributes of the organizational work environment, operationalized as transfer of training climate, are key factors influencing training transfer and training effectiveness.

Interpersonal climate dimensions were among the most powerful predictors of performance in this study. Peer support, group resistance to change and supervisor sanctions all emerged as significant predictors of performance with Beta values of .52, .38, and .39 respectively ($p \leq .01$). It is clear from these results that work group members' belief about themselves as a group, normative expectations about group members' work behavior, and supportive interpersonal relationships were highly influential factors dictating the use of training on the job.

A new group level dimension of transfer climate, change resistance, emerged as a significant predictor of performance in this study. This construct was composed of items that suggested a normative group resistance or acceptance to introducing new learning from training. Change resistance has received very little research attention in the training literature although there are indications that a transfer dimension of this nature may be of some value. A study of transfer reported by Hastings, Sheckley, and Nichols (1995), for example, found that one environmental constraint to transfer was participants' belief that training would disrupt the functioning of current work groups. In addition, conceptually similar constructs such as openness to experience (Barrick & Mount, 1991) at the individual level and continuous learning culture (Tracy et al., 1995) at the organizational level have been shown to be valuable constructs in understanding knowledge acquisition and use.

Content Validity A strong positive association between content validity and performance utility was found suggesting that the job relevance of training content affects transfer motivation. High levels of training content validity were associated with high levels of perceived utility which some researchers (e.g., Noe, 1986) have suggested moderates the relationship between learning and behavior change and is therefore an integral part of motivation to transfer. This finding is consistent with adult learning theory and expectancy theory perspectives.

The results of the hierarchical regression analysis suggest that (a) the relationship between content validity and performance is not totally mediated by performance utility, and (b) content validity may have a direct relationship with performance. These findings further suggest the value of systematic needs analysis prior to training design or, in the case of existing training programs, the potential value of pre-training evaluations of training content.

Performance Utility The correlations between performance utility and the other predictor variables were among the largest effects obtained in this study. Of the 10 variables correlated with performance utility, eight were categorized as large ($r \geq .41$) and two as medium ($r = -.27$ and $.33$)

Two important conclusions emerge from these correlations. First, the strong positive correlation between performance utility and organizational commitment provides preliminary evidence that organizational commitment may be an important influence on training effectiveness to the extent it predisposes individuals to view training as useful and thus enhances motivation to transfer. This finding is congruent with research demonstrating relatively high correlations between

commitment and behavioral intentions (Mathieu & Zajak, 1990; Steele & Ovalle, 1984). Second, the correlations suggest the potential value of expectancy theory as a tool for understanding training transfer. Expectancy theory (Vroom, 1964) predicts that individuals will be more motivated to learn and use training they perceive will lead to desirable performance related outcomes. Therefore variables which are perceived as facilitating attainment of performance related outcomes (e.g., content validity, opportunity to use, peer support, supervisor support, positive personal outcomes) will be positively correlated with performance utility; whereas, variables which are perceived as inhibiting attainment of performance related outcomes (e.g., negative personal outcomes, supervisor sanctions and change resistance) will yield negative correlations.

Transfer Design Transfer design, or the extent to which training is designed to give trainees the ability to transfer learning to the workplace, was the only ability/enabling element examined in this study. The findings of this study imply that one potential shortcoming of CBT as a performance improvement tool is that design dimensions necessary for supporting training transfer may, in some cases, be absent. That is, the simple transfer of classroom instruction to the computer, despite the potential for increased instructional efficiency, does not necessarily indicate that improvements in job performance will result. These issues raise important questions about whether and to what extent the use of computer-based instruction complicates the transfer of training.

Theoretical Model of Transfer The study provides partial support for a conceptual model based on Holton's (1996) comprehensive training evaluation and measurement model. The value of this model in analyzing training program success or failure lies in its ability to provide a framework in which a wide range of training inputs, processes, outputs, and environmental connections can be examined and results interpreted. The present findings demonstrate that understanding the complexity of influences on training effectiveness requires a comprehensive model of training effectiveness, one that is rich enough to account for the system-wide factors which may influence training outcomes. This, together with other research findings, (e.g., Mathieu, Tannenbaum, & Salas, 1992) underscore the necessity for comprehensive, integrated models of the training process in identifying the cause and effect of training success or failure.

Transfer Measurement Issues Extensive scale development conducted for this study resulted in multi-item scales designed to measure number of constructs including peer support, supervisor support, supervisor sanctions, change resistance, positive and negative personal outcomes, opportunity to use training, transfer design, and content validity (Holton, Bates, Seyler & Carvalho, in press). A different conceptual structure for transfer climate was identified from the factor analysis. A partial measure of motivation to transfer (performance utility) also emerged in the factor analyses. Although further testing of these scales in other settings is required to more fully establish their reliability and validity, this study provides a starting point for the definition and refinement of several potentially important transfer variables.

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Development and Validation of a Generalized Learning Transfer Climate Questionnaire: A Preliminary Report

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This study provides a preliminary report on construct validation through common factor analysis of an expanded learning transfer climate instrument. Building on our earlier work, a third generation instrument was developed measuring 16 hypothesized constructs. The Learning Transfer Questionnaire (LTQ) was then administered to 320 employees from a wide range on organizations undergoing an assortment of training. Results indicated that all but one construct is likely to be supported when the sample is enlarged, with the possibility that a few additional constructs will emerge. The instrument development process, preliminary findings, and future research agenda are described.

Investment in training activities aimed at improving employees' job performance represents a huge financial expenditure in the United States. In 1994 an estimated $52.4 billion was spent in direct costs by US employers on formal training (Lakewood Research, 1995). With the inclusion of indirect costs and informal on-the-job training, total expenditure estimates range from $200 - 400 billion annually (Broad & Newstrom, 1992). Of this expenditure, as little as 10% is projected to pay off in performance improvements resulting from the transfer of learned knowledge, skills, and abilities to the job (Baldwin & Ford, 1988). Although the exact amount of transfer is unknown, the transfer problem is believed to be so pervasive that there is rarely a learning-performance situation in which such a problem does not exist (Broad & Newstrom, 1992).

Transfer of training can be defined as the degree to which trainees apply knowledge, skills, behaviors, and attitudes learned in training to their jobs. Transfer of training is traditionally seen as a function of three sets of factors: trainee characteristics, including ability, personality and motivation; training design, including a strong transfer design and appropriate content; and the work environment, including support and opportunity to use (Baldwin & Ford, 1988). Although a good deal of research has been done on design factors (Noe, 1986), significantly less has been done to understand how work environment factors influence transfer of training (Baldwin & Ford, 1988; Tannenbaum & Yukl, 1992).

One conceptualization of the manner in which work environment factors affect the transfer of learning to the job is through a transfer of training climate. Transfer climate is seen as a mediating variable in the relationship between the organizational context and an individual's job attitudes and work behavior. Thus, even when learning occurs in training, the transfer climate may either support or inhibit application of learning on the job (Mathieu, Tannenbaum, & Salas, 1992). Several studies have established that transfer climate can significantly affect an individual's ability and motivation to transfer learning to job performance (Huczynski & Lewis, 1980; Rouiller & Goldstein, 1993; Tracey, Tannenbaum, & Kavanaugh, 1995; Xiao, 1996). Although many authors support the importance of transfer climate, some stating it may even be as important as training itself (Rouiller & Goldstein, 1993), there is still not a clear understanding about what constitutes an organizational transfer climate (Tannenbaum & Yukl, 1992).

These findings point to the need to carefully consider how transfer climate is operationalized and how it can be measured validly and reliably. In recent transfer climate research, a wide variety of instruments have been used with measures ranging from single item scales used to quantify constructs, to multiple item, content validated but situation specific scales. This raises

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several concerns. First, the tendency toward custom designed scales for each study makes generalization of findings across studies questionable and conclusions about the latent construct structure of transfer climate difficult. Second, these studies often do not include factor analyses to validate hypothesized constructs. Third, some of the scales, particularly single item measures, have questionable psychometric qualities. Not surprisingly, different studies have produced a variety of conclusions about the relationship between transfer climate and performance, perhaps because of instrumentation differences.

What is needed, and should be an important research goal for HRD research, is the development of a valid and generalizable set of transfer climate scales. An established set of transfer climate scales with validated constructs and known psychometric qualities would facilitate valid cross-study comparisons and add significantly to our understanding of the transfer process. In addition, it would facilitate transfer research by reducing or eliminating the need for redundant instrument design.

Development of a general transfer climate instrument would not preclude the addition of situation specific scales. Rather, it would provide a foundation of validated constructs with established applicability across populations and settings. Research in organizational behavior, which produced a series of tested and generally accepted job attitude scales, provides a strong example of the value of such a goal.

From a broader perspective, defining and accurately measuring transfer of training climate is important because it helps HRD move beyond the question of whether training works to why training works (Tannenbaum & Yukl, 1992). For example, without controlling for the influence of transfer climate evaluation results are likely to vary considerably and yield erroneous conclusions about the causes of intervention outcomes (Holton, 1996). A valid and reliable measure of transfer climate also has significant diagnostic potential: Such an instrument can be used to identify when an organization is ready for a training intervention and can provide information to guide pretraining interventions aimed at increasing training effectiveness. From a theoretical perspective, identifying and measuring the dimensions of the work context that impact the use of learned skills and behaviors would provide a more complete conceptual framework of training effectiveness.

The purpose of this research was to move toward the goal of a general transfer climate instrument. Earlier research (Holton, Bates, Seyler, & Carvalho, in press), reported on initial attempts to validate the transfer climate constructs and instrument proposed by Rouiller and Goldstein (1993). Significant differences were found in construct structure that led to the conclusion that Rouiller and Goldstein's constructs should not be the basis for a generalized instrument. The Holton et al. study factor analyzed an expanded transfer climate instrument incorporating several unexplored constructs. The nine factor solution that emerged indicated the presence of additional climate constructs and indicated that transfer climate was perceived according to organizational referent.

This study builds on that previous work by expanding the instrument again to include what are believed to be a comprehensive set of constructs affecting the potential for training to transfer to the job. As shown in Figure 1 below, Holton's (1996) proposed evaluation model was used as a conceptual base for this instrument along with the two studies cited above. The primary purpose of this paper is to provide a preliminary report on initial construct validation work using factor analysis. More specifically, it addressed the following research question:

> *Research question*: Will exploratory factor analysis of the Learning Transfer Questionnaire (LTQ) result in an interpretable factor structure of latent transfer climate constructs?

A second purpose is to discuss ongoing development research on this instrument.

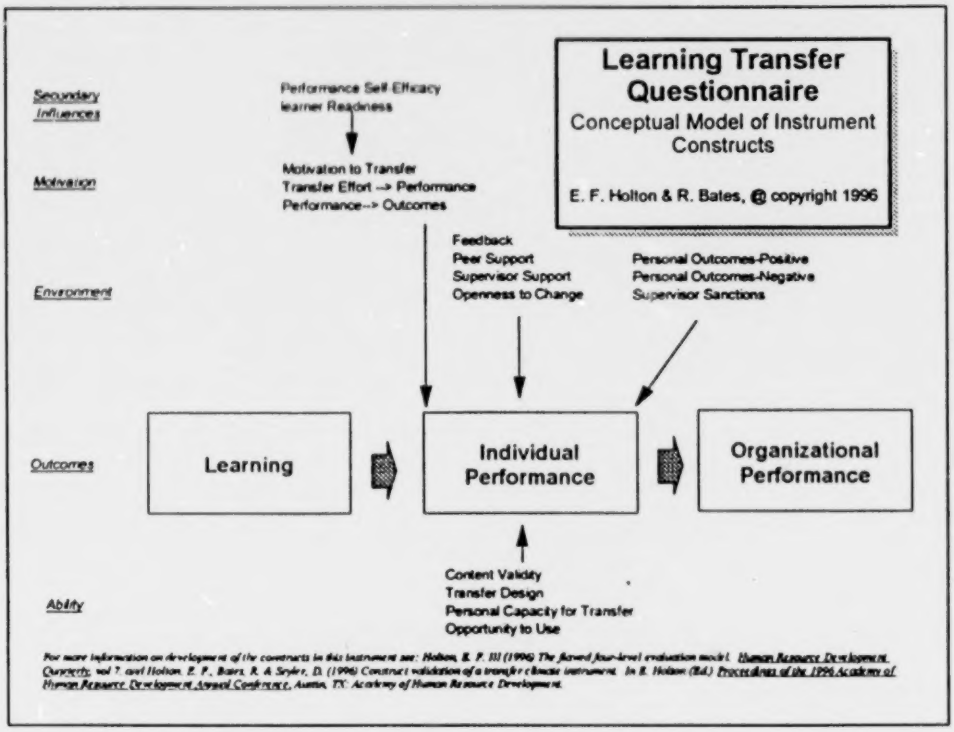
Method

Instrument Development A pool of 112 items were generated to represent 16 hypothesized constructs. We began with the 64 item instrument that emerged from our previous work (Holton et

al., in press) which had its beginning with the Rouiller and Goldstein(1993) instrument. This instrument had shown initial evidence of content, construct and criterion validity (Bates, Holton, & Seyler, 1997; Seyler, Holton, Bates & Carvalho, 1997).

Because the instrument which emerged had a disproportionate numbers of items across constructs (e.g. 23 items measuring supervisor support), we first reduced the number of items by selecting only the highest loading items from its large scales. Next, we examined the literature to identify other constructs that had not previously been measured. Important additions included constructs such as performance self-efficacy, expectancy related constructs (transfer effort-performance and performance-outcomes), personal capacity for transfer, feedback and general motivation to transfer. We then fit these constructs into the theoretical framework of the HRD Research and Evaluation Model (Holton 1996) as shown in Figure 1.

The items were divided into two sections. For the first section, containing 76 items representing 11 constructs, trainees were asked to consider the specific training program they were attending. The instructions for this section were to "think about this specific training program." Another 36 items, representing 5 constructs, were placed in the second section. Trainees were instructed to "think about training in general in your organization." Constructs in the second section included transfer effort-performance, performance-outcomes, openness to change, performance self-efficacy, and feedback.


Learning Transfer Questionnaire
Conceptual Model of Instrument Constructs
E. F. Holton & R. Bates, © copyright 1996
Secondary Influences
Performance Self Efficacy
learner Readiness
Motivation
Motivation to Transfer
Transfer Effort --> Performance
Performance--> Outcomes
Environment
Feedback
Peer Support
Supervisor Support
Openness to Change
Personal Outcomes-Positive
Personal Outcomes-Negative
Supervisor Sanctions
Outcomes
Learning
Individual Performance
Organizational Performance
Ability
Content Validity
Transfer Design
Personal Capacity for Transfer
Opportunity to Use
For more information on development of the constructs in this instrument see: Holton, E. F. III (1996) The flawed four-level evaluation model. Human Resource Development Quarterly, vol 7, and Holton, E. F., Bates, R. & Seyler, D. (1996) Construct validation of a transfer climate instrument. In E. Holton (Ed.) Proceedings of the 1996 Academy of Human Resource Development Annual Conference, Austin, TX: Academy of Human Resource Development.

Sample The LTQ was administered to 320 people in a wide variety of organizations and training programs. Because the purpose of this research program was to develop a generalized instrument that can be used across a wide range of training programs and organizations, the sample had been deliberately chosen to be as heterogeneous as possible.

This sample included respondents from a shipping company, power company, chemical manufacturer, municipal government, state government, and open session classes offered to the public. The municipal and state government classes were offered by a central training organization so the classes included representatives from a wide variety of agencies and functions. The open

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session classes consisted of mostly small and mid-sized private sector companies.

A wide range of employees from secretaries to managers and professionals attended the various training sessions. Although the classes covered a variety of training topics including sales, computer skills, leadership, mid-management skills, and supervision, one limitation of this initial study is that is it weighted somewhat more heavily toward management training.

Analysis. Exploratory common factor analysis was used to identify the underlying latent structure of the data. Common factor analysis is more appropriate than principal components analysis when the objective of the analysis is to identify latent structures, rather than for predictive purposes (Nunnally & Bernstein, 1994). An oblique rotation was used because it is also more appropriate for latent variable investigation when latent variables are expected to have some correlation.

Construct validation has traditionally consisted of establishing convergent and divergent validity with other constructs through correlational studies. More recently, factor analysis has been recognized as "a powerful and indispensable method of construct validation (Kerlinger, 1986, p. 427)" that "is at the heart of the measurement of psychological constructs (Nunnally & Bernstein, 1994, p.111)." The combination of common factor analysis with convergent and divergent validity studies results in a more complete construct validation.

The items in the two sections of the instrument represented two distinct construct domains: specific transfer climate and general transfer climate. They were therefore factor analyzed separately with 76 items pertaining to the specific training program in one pool, and 36 items pertaining to general transfer climate in the second pool.

This resulted in a respondent to item ratio of 4.2:1 for specific training items, and 8.9:1 for general climate items. Generally a ratio of between 5:1 to 10:1 is desirable (Hair, Anderson, Tatham, & Black, 1995), though it is not uncommon to find smaller ratios (Ford, MacCallum, & Tait, 1986). We consider this only a preliminary report because larger ratios will be important for a general instrument with wide applicability.

Results

Because this paper is a preliminary report, it is more appropriate to discuss the findings at the construct level and not report item loadings until complete data is available. This study provides initial evidence of viability of this research effort and this specific instrument.

Training Specific Items Kaiser's measure of sampling adequacy (MSA) for the entire data set, a measure of the data set's appropriateness for factor analysis, was .876. Values above .80 are considered appropriate for factor analysis (Hair et al., 1995). Eighteen factors were identified with eigenvalues greater than one. However, examination of the scree plot revealed that the actual number of factors might be 13, close to the 11 hypothesized. Factor structures were exceptionally clean with very minimal cross-loadings.

Table 1 reports evidence of scale viability based on these initial results. Several conclusions are apparent. First, all but one of the hypothesized factors (supervisor barriers) received at least some support. Second, eight scales showed good factor structure, though one of them (motivation to transfer) split into two scales, one containing negative affect items and one positive affect items. Third, two of the scales had only two items loading on the factor and may need additional work.

General Transfer Items Kaiser's measure of sampling adequacy (MSA) for the entire data set, a measure of the data set's appropriateness for factor analysis, was .878. Eight factors were identified with eigenvalues greater than one. However, examination of the scree plot revealed that the actual number of factors might be only 6, closer to the 5 hypothesized. Factor structures were exceptionally clean with very minimal cross-loadings.

Table 1: Initial Factor Results for Specific Training Items

Construct	Initial Items	Items loading	Status
Learner Readiness	7	5	good
Motivation to Transfer	7	6	split into two scales
Personal outcomes-positive	8	2	weak
Personal outcomes-negative	7	6	good
Personal capacity for transfer	6	2	weak
Peer support	7	4	good
Supervisor/manager support	8	8	good
Supervisor barrier	6	0	poor
Perceived content validity	7	3	good
Transfer design	6	4	good
Opportunity to Use	7	2	weak

Table 2 reports evidence of scale viability based on these initial results. Several conclusions are apparent. First, all of the hypothesized factors received support. Second, one scale, transfer effort-performance, split into two scales, one containing negative affect items and one positive affect items.

Table 2: Initial Factor Results for General Training Items

Construct	Initial Items	Items Loading	Status
Transfer effort-performance	8	7	split into two scales
Performance-outcomes	7	6	good
Openness to Change	7	5	good
Performance self-efficacy	8	5	good
Feedback	6	3	good

Discussion/Implications

As HRD shifts toward performance management, measurement of transfer climate will become more important. Validation studies such as this are important to develop standard instruments to measure climate across multiple organizations and intervention types.

This study provides initial evidence of the viability of the Learning Transfer Questionnaire. Although these conclusions are tentative, early indications are that all but one of these constructs will be supported when additional data is collected. This is reinforced by the stronger results in the general climate section of the instrument where the respondent-item ration is approaching 10:1 and

the results are much closer to the hypothesized constructs. However, the most important finding to emerge from this research is not that the specifically hypothesized constructs were exactly confirmed. More significant is the indication that a set of clean, interpretable constructs can be identified and scales constructed to measure them. The initial results are quite encouraging that we are moving closer to this goal.

The open issue at this point is whether the additional factors which emerged from this factor analysis are indicative of true additional factors, or simply a statistical artifact due to the low respondent-item ration. We are speculating that it is more the latter, particularly for the specific training items section of the instrument. For example, of the 18 factors which had an eigenvalue greater than 1, factors 15 -18 had no items loading higher than .48, a relatively low loading. Factors 12 - 14 were all 2 item factors which usually have low reliabilities. We speculate that at least some of these factors will disappear with a larger sample.

The lack of an interpretable factor resembling the "supervisor barrier" construct may be due to the large number of management personnel in this initial sample. Since management personnel are not commonly under close supervision by their bosses, it is possible that supervisor barriers would not be a relevant construct to them. This is an area that will require closer investigation.

One interesting finding is that two of the scales, motivation to transfer (a specific training item) and transfer effort-performance (a general training item), each split into two scales. In both cases, the split separated the positive affect items from the negative affect items. Both of these scales are also conceptually similar in that they tap motivational constructs. For example, positive affect items from the motivation to transfer scale included "I get excited when I think about trying to use my new learning on my job" and When I leave training, I can't wait to get back to work to try what I learned". Negative affect items that split apart from this scale included "I hope I will have a chance to use what I learn at my job" and "I will be disappointed if I don't get to incorporate what I learned in to the way I do my job." For the transfer effort-performance scale, positive affect items included "The harder I work at learning, the better I do my job" and "The more training I apply on my job, the better I do my job." Negative affect items included "Trying to use new things on my job just doesn't make any difference" and "There isn't much I can do to improve my job performance." Conceptually the factor separation is similar and may indicate important new construct definitions if confirmed with a larger sample.

Conclusion

Development of a valid and generalizable transfer climate instrument is an ambitious research goal. Based on the experience in other fields of study, we know it can be accomplished and that there is substantial payoff for pursuing an agenda of this type. With psychometrically strong instrumentation, HRD will be in a position to provide more definitive answers to questions about the nature of training transfer and about barriers and enablers to transfer in the work environment.

This preliminary report on the Learning Transfer Questionnaire project indicates that we are approaching the point where such an instrument may exist. Our research agenda in the coming months includes the following steps:

1. Collecting additional data to complete the construct validation with factor analysis.
2. Completing construct validation by establishing convergent validity with constructs believed to be related to transfer climate and divergent validity with constructs expected to be minimally related.
3. Criterion validation in evaluation studies with strong performance measures at the individual and organizational levels.
4. Confirmatory validation studies to confirm validity across multiple companies and training situations.

In a forthcoming reply (Holton, Bates, Seyler & Carvalho, in press) to reactions to our earlier work on this instrument (Holton, et al., in press), we make this statement: "Both authors (who

reacted to our article) challenge transfer of learning scholars to engage in collaborative and coordinated efforts in a broad based and ambitious transfer climate research agenda. We agree, and would like to join in their challenge. Our commitment is to make our instrument available to any researcher wishing to test it and collaborate on improving measurement of transfer climate."

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Training Effects on Productivity and Work Quality After the Introduction of New Technologies in the Organization - an Exploratory Study

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The purpose of this study was to describe the effects of training on productivity and quality after the introduction of new technologies in the organization. The conceptual framework of the study was based on the training transfer and sociotechnical systems theories. This exploratory study concluded that a work environment adhering to sociotechnical principles and design acts as a catalyst to training transfer and improvements in productivity and quality.

According to such training evaluation gurus as Kirkpatrick (1987) and Phillips (1988), one of the main objectives of training evaluation is to associate training results with organizational improvement. Such training results are reduced costs, improved efficiency, and increases in quantity and quality.

Given the existence of many other complicating factors, however, some results of a training program are very difficult, if not impossible, to evaluate. In particular, Kirkpatrick (1987, p. 315) states: "A difficulty in the evaluation of training is evident at the outset, technically called 'the separation of variables'; that is, how much of the improvement is due to training as compared to other factors? This is the problem that makes it very difficult to measure results that can be attributed directly to a specific training program." In most cases, Kirkpatrick continues, the measure on a before-and-after basis is directly attributed to the training program even though other factors may have been influential.

Despite the importance of identifying the organizational factors that can influence the results of a training program, little empirical research has been conducted to holistically assess the impact of training on the organization (Baldwin & Ford, 1988; Black & Lynch, 1996; Clark, Dobbins, & Ladd, 1993; Holton, 1996; Rouiller & Goldstein, 1993; Tracey, Tannenbaum, & Kavanagh, 1995). With regard to the weaknesses of training research, Rouiller and Goldstein (1993), stated that "in nearly all studies of training outcomes, the emphasis has been on identifying and examining the characteristics of training programs and individual learners and relating these factors to training and job performance" (p. 377). This approach, the authors continue, ignores the characteristics of the job situation and whether these characteristics influence the transfer of training behavior onto the job.

The problematic nature of training research is also emphasized by Tracey et al. (1995) who stress that most research on training effectiveness has focused on factors within the training program, such as training content and design, while most evaluation efforts have concentrated on reaction and learning measures, which in turn also fall within the training context. Tracey et al. (1995) further point out that despite the potential importance of the work environment, very little research has been conducted to operationalize and empirically assess training-specific situational factors that either facilitate or impede the application of newly learned skills on the job.

Purpose of the Study

Given the existing lack of knowledge with regard to the association of training effectiveness and organizational improvement, the purpose of this exploratory study was to describe the effects of training on productivity and work quality after new technologies were introduced in the organization. Since prior research in this area has been very limited, a secondary objective of this study was to develop a reliable and valid survey instrument with which all the relevant variables and constructs could be assessed. The theoretical framework of the study was based on the training transfer and sociotechnical systems (STS) theories which in turn furnished the moderating organizational variables projected to have an influence on trainee performance.

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Training Transfer Variables In short, the following training transfer climate variables that were found by the Rouiller and Goldstein (1993) as well as the Tracey et al. (1995) studies to have a direct effect on post-training behaviors were incorporated in the survey instrument of the study:

1. The degree to which characteristics of a trainee's job prompted or reminded him or her to use new skills and knowledge acquired in training (task cues).
2. The degree to which trainees were openly discouraged from using new skills and knowledge acquired in training (punishment consequences).
3. The degree to which supervisors supported and encouraged the application of new skills and knowledge acquired in training (supervisory support for new skills).
4. The degree to which trainees received extrinsic rewards for using newly learned skills and knowledge acquired in training (extrinsic reinforcement consequences).
5. The degree to which trainees received intrinsic rewards for using newly learned skills and knowledge acquired in training (intrinsic reinforcement consequences).
6. The degree to which the users of the new technology functioned in a work environment which emphasized innovation and competition (innovative-competitive organization).
7. The degree to which the users of the new technology functioned in an environment in which supervisors and coworkers strongly encouraged the acquisition and use of any new relevant skills and behaviors (social support for new skills).

Organizational Moderator Variables The derivation of the following 10 questions that dealt with the work environment within which the training and new technology interventions were introduced, was based on Pasmore's (1988) STS assessment survey, the properties of motivating jobs as defined by Hackman and Oldham (1980), and the comprehensive seven year meta-analysis study by Macy and Izumi (1993) in which the d-effects of 60 sociotechnical action-levers on organizational outcomes were examined. The purpose of these questions was to determine the degree to which the new technology was introduced in an organization whose design was consistent with sociotechnical systems principles, which in turn "have been demonstrated to produce high levels of commitment and performance" (Pasmore, 1988, p. 157).

8. The degree to which the users of the new technology functioned in a very participative organization characterized by a high degree of employee involvement (Participative organization).
9. The degree to which the users of the new technology were members of self-directed teams (self-directed teams).
10. The degree to which the users of the new technology were intimately involved in communications and decisions regarding the design and development of the new technology (employee involvement).
11. The degree to which the users of the new technology functioned in a multiskill work environment characterized by a common job classification system (multiskill work environment).
12. The degree to which the users of the new technology worked in a flat and decentralized organization, composed of mini-enterprises functioning within the firm (flat organization).
13. The degree to which the users of the new technology frequently participated in multiskill training and retraining programs and were rewarded for doing so (multiskill training environment).
14. The degree to which the users of the new technology were involved in enriched jobs that required a variety and higher level skills which in turn took a long time to master (skill variety).
15. The degree to which the users of the new technology did a whole and complete piece of work and had the authority to make all important decisions about it throughout the process (task identity).
16. The degree to which in carrying out their work activities required by the job, the users of the new technology received clear information about the effectiveness of their performance from the job itself and their supervisors (job/supervisory feedback).
17. The degree to which the users of the new technology functioned in an environment in which a great deal of information about business was shared with employees (information sharing).

Productivity and Work Quality In this study productivity and work quality were measured at the individual level, and each was based on a set of three and five indicators respectively. For the purposes of this study employee productivity was defined in terms of the following three indicators: a) employee output per unit time; b) completion rate of work output; and c) cost reduction. The five indicators that comprised the work quality dimension were: a) internal/external customer satisfaction with

quality of work output; b) number of changes or reworks required as % of pieces produced; c) scrap as % of units produced; d) delivery rate of expected output; and e) % of work output meeting specifications.

Research Questions

In all, this study attempted to answer the following research questions:

Research Question 1 If training is used during the introduction of new technologies in the organization, to what extent are the following instructional system components associated with the identified productivity and work quality indicators?

1. Needs assessment (person analysis, task analysis, organizational analysis).
2. Goals and objectives.
3. Audience analysis.
4. Learning task analysis and/or procedural analysis.
5. Evaluation (Pre-test, trainee reactions, summative, impact).

Research Question 2 If training is used as a coping strategy during the introduction of the new technology in the organization, what is the degree of association between the productivity and work quality indicators and the identified training transfer and organizational moderator variables?

Methodology

Subjects The sampling frame of this study consisted of 4097 training, human resource, quality, and organization development professionals who were national members of the American Society of Training and Development (ASTD) and were listed under the Total Quality Management section of the 1995 directory. Out of these 4097 national members, 971 were randomly selected to participate in the study through the circular systematic sampling procedure.

Response rate. The overall response rate for this study was calculated at 33.26% (323/971). Of the 323 returned surveys, 59 belonged to participants who were unable to provide the necessary data and they were therefore returned blank. Furthermore, 29 of the mailed surveys were sent to addresses that were experiencing delivery problems and they were thus dropped from the sample. In all, 264 of the returned surveys (27.19%) had usable data upon which the statistical analysis of this study is based on.

Participants. The participants of this study consisted of training, human resource, organization development, and quality managers with an average age of 43.35 years (SD = 8.32). Fifty-eight percent of the respondents were male and each participant had held his or her present job for an average of 4.65 years (SD = 3.70). Collectively, 96.4% of the respondents had a college degree and represented 46 states. Furthermore, the respondents worked in all sectors of the industry with manufacturing (33.19%), health care (10.54%), and financial services (10.14%) being the majority. Finally, the participants of this study worked in organizations that on the average employed 7,595 employees (SD = 19,244).

In terms of the new technology introduced in the organization, representing 77.2% of valid responses, information technology (i.e., a technology that stores, retrieves, analyzes, or transmits information) was overwhelmingly the type of technology most respondents (203/264) introduced in their organization during the last five years. On the other hand, computer-aided manufacturing technologies (such as robotics and computer-aided design and manufacturing), materials technologies (such as ceramics and nonmetallic composites), and biotechnologies (i.e., technologies that use living organisms to modify plants or animals) were introduced by only 10% of the respondents. The remaining 11.8% of participants introduced a variety of other technologies, such as new equipment or machinery, production systems, and process operations.

Instrument The instrument for this study consisted of a mail questionnaire which was custom-designed for the purposes of this study. The questionnaire was comprised of 39 questions and was pilot-tested on a group of 50 participants before the conduction of the main study.

Method Once the pilot-study was conducted and appropriate changes to the instrument were made, the finalized survey questionnaire was sent to the randomly selected participants. A week after the first mailing a postcard reminder was mailed to all participants. Three weeks after the initial mailing, a

second cover letter and a second questionnaire were sent to all non-respondents. The survey was closed three weeks later.

Data analysis After the data from the 264 participants was collected, both descriptive and inferential statistics were used to analyze it. With regard to research question 1, a correlational analysis indicated the degree of association between the instructional system components and productivity as well as work quality indicators. A correlational analysis was also used to partly answer research question 2. Further, multiple regression analyses were used to determine how the instructional system components in conjunction with the identified training transfer and organizational moderator variables and factors related to each one of the identified productivity and work quality indicators.

Stepwise regression was the selection method used when building the regression models for this study. The F-to-enter and F-to-remove values used were 0.05 and 0.01 respectively. In order to increase the reliability of the produced regression models, all outliers greater than three standard deviations were excluded from the analysis.

In terms of reliability, coefficient alpha was calculated for all Likert scale items of the questionnaire. As in the case of reliability, all Likert scale items were also used to empirically construct validate the instrument through the use of a principal components analysis. For this study, the criterion used in order to determine how many components to retain was that of Kaiser (i.e., only components whose eigenvalues are greater than 1 are retained), which according to Stevens (1986) is one of the most accurate and widely used ones.

Results

Reliability and Construct Validity In terms of reliability, coefficient alpha for the Likert type items of the instrument was measured at 0.87. In terms of construct validity, the principal components analysis that used a varimax rotation produced a four-factor solution that accounted for 55.1% of the total variance. The sample size utilized for the principal components analysis was 242 for which the critical value for significant loadings was calculated at |0.33| (Stevens, 1986).

In short, the first rotated factor which accounted for 33.7% of the total variance had the highest factor loadings (fl) from the following eight variables: innovative-competitive organization (6; fl = 0.51); social support for new skills (7; fl=0.66); participative organization (8; fl=0.82); self-directed teams (9; fl=0.56); employee involvement (10; fl= 0.50); flat organization (12; fl=0.52); multiskill training environment (13; fl=0.62); and, information sharing (17; fl=0.79).

From the above variable descriptions, it becomes evident that the first rotated factor deals with the general organizational environment within which the new technology was introduced. Given that the variables that highly correlate with this factor are those that were incorporated in the questionnaire in order to determine the degree to which the new technology was introduced in an organization whose design was consisted with sociotechnical systems (STS) principles, this factor can be interpreted as the "STS organization" factor.

The second rotated factor, which accounted for 8.2% of the total variance, highly correlated with the following variables: multiskill work environment (11; fl=0.70); skill variety (14; fl=0.68); task identity (15; 0.69); job/supervisory feedback (16; fl=0.44). In all, the second rotated factor was successful in grouping the variables that were incorporated in the instrument in order to describe the job dimensions of the work performed by the users of the new technology. This factor was defined as the "job design" factor.

The third factor of the varimax rotated factor matrix accounted for 7.1% of the total variance and drew the highest loadings from the following three variables: task cues (1; fl= 0.74); punishment consequences (2; fl=0.53); and, supervisory support for new skills (3; fl=0.64). Unlike the first two factors which dealt with the organizational and job environment in general, the third factor dealt with the training transfer climate in which the application of new skills and knowledge took place. This factor was therefore interpreted as the "training transfer climate" factor.

The fourth and final rotated factor accounted for 6.1% of the total variance and had the highest loadings from the following two variables: extrinsic reinforcement consequences (4; fl=0.83); and intrinsic reinforcement consequences (5; fl=0.61). The last factor can thus be interpreted as the "rewards for new skills" factor.

In summary, the principal components analysis and varimax rotation produced a four factor solution which was successful in empirically construct validating the instrument. More specifically, the produced factors were able to differentiate between the STS, job design, and training transfer climate variables. It is worth noticing that the innovative-competitive (6) and social support (7) variables which were described by Tracey et al. (1995) as "continuous -learning culture scales" were found to be more highly associated with the "STS organization" factor rather than the "training transfer climate" factor. This finding in essence validates the assertion expressed by Tracey et al. (1995) that a sociotechnical organization is conducive to a work environment that promotes a positive training climate and a positive learning culture.

Significant Correlations of Productivity and Work Quality Indicators With Instructional System, Training Transfer, and Sociotechnical Variables A summary of all significant Pearson correlations between the productivity/work quality indicators and instructional system, training transfer, sociotechnical variables, and four factors is depicted in Table 1. For comparison purposes, Table 1 also contains a summary of all intercorrelations of the productivity and work quality indicators with the posttest and training retention variables. Once again, the variables of employee output, completion rate of work output, and cost reduction represent the productivity indicators, while the remaining five indicators in Table 1 represent the work quality ones. Furthermore, the variables or factors that were selected by the respective regression models as predictors are underlined for easy reference.

The amount of total variance accounted for by the produced regression model for each indicator, were as follows: employee output - 17%; completion rate - no regression produced; cost reduction - 17%; internal/external customer satisfaction with quality of work output - 37%; rework reduction - 11%; scrap reduction - 19%; improvement in the delivery rate of expected output - 9%; and, improvement in the percentage of work output meeting specifications - 16%. It should be noted that when building the above regression models the training retention variable was excluded from the analysis due to the small sample size associated with it (n=40).

Before proceeding with the analysis, it is also important to state that not all post-test and training retention scores reported by the participants were actual measurements. More specifically, out of 113 reported post-test scores, 91 or 80.53% were actual measurements which resulted from a summative evaluation, while 22 or 19.47% were estimates. In the case of training retention, only 21 (52.5%) of the 40 reported scores were actual measurements of an impact evaluation that took place three to nine months after the completion of the training program. In terms of mean scores, the mean value of the measured post-test scores is 80.99%, while for the estimates is 64.77%. The difference between the two mean values is 16.22 percentage points and is significant at the 0.001 level . For training retention, the difference between the mean values of the actual measurement (77.67%) and estimated (79.53%) scores is 1.86 percentage points and non-significant.

In terms of the degree of association between the productivity and work quality and training performance, the correlations between post-test as well as retention of training with the productivity and work quality indicators reveal that overall, knowledge of training material immediately after training (posttest score) has a weak association with the identified indicators. The only exception is the significant correlation between post-test score and internal/external satisfaction with work output ($r = 0.266$, $p < 0.05$).

Unlike post-test score, retention of training material three to nine months after completion of training seems to have a relatively much stronger association with the productivity and work quality indicators. In particular, five of the eight correlations between retention of training and the indicators were above 0.200, whereas only one correlation between the post-test score and the indicators was above 0.200. Moreover, it is worth noting that compared to the remaining 24 instructional system, training transfer, and organizational variables shown in Table 1, retention of training material was found to exhibit the highest correlations with the productivity and work quality indicators. It should be noted, however, that the retention of training variable was not incorporated in any of the regression models due to the small sample size associated with it.

According thus to the findings presented so far, one may conclude that retention of training material is a better predictor for productivity and work quality than knowledge of training material immediately after training. Furthermore, one may conclude that retention of training is one of the most

Table 1

Summary of Significant Correlations of the Productivity and Work Quality Indicators[1]

	Employee output	Completion rate	Cost reduction	Customer satisfaction	Rework reduction	Scrap reduction	Delivery rate imprv.	Specifications imprv.
Post test score	.134	.061	.158	.260	-.025	-.028	.087	.076
Retention score	.329	.028	.288	.350	.340	.180	-.078	.237
Person analysis	.276**	.....	.....	.193	.....	.....	.193	.248*
Task analysis	.....	.....	.240	.204	.....	.....	.221	.220
New tech need - top mgt	.....	.....	.....	.....	.234*	.....	.....	.197
New tech need - suprvs	.....	.....	.213	.168	.....	.....	.229	.....
New tech need - trainees	.....	.....	.....	.172	.....	.....	.....	.....
New tech need - other stakehs	.282*	.....	.263*	.....	.191	.220	.....	.....
Tmg need - top mgt	.....	.....	.211*	.....	.....	.....	.....	.....
Tmg need - Supervs	.....	.....	.....	.175	.....	.....	.....	.....
G&O Tmg mngr	.....	.....	.200	.183	.....	.....	.....	.....
Learning task/ procedrl analysis	.....	.....	.....	.....	.....	.....	.....	.267*
Trainee reactions	.....	.....	.....	.200*	.....	.....	.....	.....
Task cues	.169	.....	.....	.181	.....	.....	.190	.....
Suprv support	.....	.....	.....	.182	.181	.....	.....	.....
Intrinsic reinf	.180	.219	.....	.411**	.....	.....	.232	.264*
Innov-comp org	.....	.....	.....	.220*	.215	.239	.184	.262*
Social support	.....	.....	.....	.193	.....	.....	.175	.281*
Multiskill work env	.182	.....	.....	.197	.....	.....	.....	.267*
Flat org	.....	.....	.....	.....	.....	.234	.....	.....
Multiskill tmg env	.....	.....	.....	.....	.....	.....	.....	.180
Skill variety	.....	.....	.....	.189	.....	.....	.....	.269*
Task identity	.....	.....	.....	.212*	.....	.....	.....	.184
Job/suprv feedback	.....	.....	.....	.193	.....	.....	.....	.....
Info sharing	.....	.....	.....	.158	.....	.....	.....	.....
STS org factor	.....	.....	.....	.....	.....	.....	.....	.....
Job design factor	.....	.....	.....	.165	.....	.....	.....	.184
Training transfer climate factor	.236**	.....	.....	.231*	.....	.....	.....	.....
Rewards for new skills factor	.....	.....	.....	.....	.....	.....	.....	.192

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

1. Underlined variables or factors reflect predictors selected by the corresponding regression model.

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influential variables that can positively affect productivity and work quality. These conclusions should be viewed with caution however, given the small sample size associated with the retention of training variable. In addition, given the lack of knowledge with regard to when exactly the productivity and work quality measurements were provided, it is not known to what extent the significant correlations listed in Table 1 would have been different had the furnished productivity and work quality measurements represented the final impact of the new technology intervention.

With regard to the degree of association between the productivity/work quality indicators and instructional system design (ISD) components, person analysis (conducted to determine who in the organization needed training in order to use the new technology) and task analysis (conducted to determine the critical activities or work operations required by the new technology) proved to be the most important ISD variables. Both of these ISD components were found to be significantly correlated with one productivity and three work quality indicators respectively. However, since person analysis was selected by two of the seven created regression models and task analysis by none, one may infer that determining who in the organization needs training in order to use the new technology constitutes the most important ISD component for productivity and work quality improvement.

As far as stakeholder involvement in the decision with regard to the need of the new technology is concerned, the data in Table 1 indicates that participation of all key stakeholders (top management, supervisors, trainees, and others, such as MIS, engineering, and redesign teams) in this decision positively and significantly correlated with seven of the eight indicators. Based thus on these findings, it is safe to conclude that participation of all relevant stakeholders in the decision with regard to the need of the new technology is an essential ingredient for a successful new technology intervention in an organization.

With regard to the degree of association between the productivity and work quality indicators with the training transfer and other organizational variables, intrinsic reinforcement for the application of new skills and knowledge acquired in training and an organizational environment that emphasizes innovation and competition, proved to be the most important variables. More specifically, of all the variables shown in Table 1, both, intrinsic reinforcement and innovative-competitive organization were found to exhibit the highest number (5) of significant correlations with the productivity and work quality indicators. The importance of intrinsic reinforcement for the application of new skills and knowledge can be highlighted even further by noting that its correlation with the internal/external customer satisfaction with the quality of work output indicator ($r = 0.411$, $p < 0.01$) represents the highest correlation depicted in Table 1.

Other training transfer and organizational variables that were found to be significantly correlated with at least three productivity or work quality indicators were: task cues - the degree to which the trainee's job prompted or reminded him or her to use the new skills and knowledge acquired in training; social support - the degree to which the user of the new technology functioned in an organization in which supervisors and coworkers strongly encouraged the acquisition and use of any new relevant skills and behaviors; and, multiskill work environment - the degree to which the users of the new technology functioned in a multiskill work environment characterized by a common job classification system.

Conclusions

In summary, the new technology and training interventions were found to be more closely associated with improvements in productivity and work quality when they were introduced in an organizational environment which supported, encouraged, and rewarded the acquisition and application of new skills and knowledge, as well as emphasized innovation and competition. Again, these findings are consistent with sociotechnical theory and quantitatively support the premise that investments in the development of the social system can assist the organization achieve higher levels of productivity and quality.

Based on the results shown in Table 1, one may also conclude that the identified training and organizational variables are more highly associated with work quality, rather than productivity. In particular, the five work quality indicators collectively were found to exhibit 43 significant

correlations with the identified training and organizational variables, while the three productivity indicators with only eleven. This discrepancy in the number of significant correlations with the training transfer and other organizational variables may be attributed to primarily two reasons: a) improvements in productivity depend on full mastery of new skills and knowledge which in turn takes time to occur; and, b) productivity is dependent on work quality.

As far as the interrelation between productivity and quality is concerned, Deming (1986) has long advocated that improvements in productivity are dependent on improvements in quality. Deming's assertion is that as quality improves, costs decrease because of less rework, fewer mistakes, and fewer delays. As Deming (1992) put it, "improvement in quality transfers waste of man-hours and of machine-time into the manufacture of good product and better service. The result is a chain reaction - lower costs, better competitive position, happier people on the job, jobs, and more jobs" (p. 2).

In many respects then, the fact that the findings of this study show a higher degree of association between the training and organizational variables with work quality improvement, rather than productivity improvement, should be considered as an expected outcome that follows and validates existing conceptual theories. Another implication that stems from this study therefore, is that one should expect improvements in productivity to take longer to materialize, compared to work quality, when introducing new technologies in the organization. How longer it will take for productivity to improve will most likely depend on the sociotechnical nature of the organizational environment within which the training and new technology interventions are introduced.

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Climate For Training Transfer: A Progress Review and Recommendations for Further Research

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Baldwin and Ford's 1988 review of the training transfer literature found existing research to be limited and problematic, especially in regard to the study of the effect of work environment on transfer. This paper examines the empirical studies conducted on work environment since Baldwin and Ford's review to determine what progress has been made on their research recommendations and what research gaps continue to exist.

Transfer of training, defined as the effective and continuing application of newly acquired knowledge, skills, and attitudes to the job, is a crucial issue for human resource development professionals (Broad & Newstrom, 1992, Wexley & Latham, 1991). Enormous investments in training are believed to be largely wasted because of inadequate transfer, especially in the "soft skill" areas of management development. For example, Dixon (1990), after examining three decades of evaluation studies on management development programs, concluded that the programs appeared to have little lasting impact.

In their review of the training transfer literature, Baldwin and Ford (1988) proposed a conceptual framework for understanding and studying the transfer process. They suggested that training transfer is a function of three variables: (1) trainee characteristics, (2) learning and retention, and (3) work environment. The degree of learning and retention, in turn, is impacted by training design and also influenced by trainee characteristics and work environment.

Of these three input factors to transfer (design, trainee, and environment), Baldwin and Ford found that work environment had the least amount of empirical research available to guide practice. They found only seven studies that examined the influence of the work environment on transfer of training and none that attempted to change the work environment itself. In their critique of the work environment research, Baldwin and Ford identified four major problems, all methodological in nature: correlational data, self reports of behavioral change, inadequate time frames, and inadequate sampling across work groups and organizations.

In their conclusions and recommendation for further research, Baldwin and Ford stressed the need to identify and operationalize key work environment variables, such as supervisory support, to a level of specificity that allows for development of interventions for changing environment characteristics and testing their effects on transfer. They called for more robust measures of the generalization and maintenance of behaviors, with the measures taken at multiple intervals over longer periods of time to examine the interactive effects of work environment and time on skill utilization and skill decrements. Finally, they suggested that the effects of work environment characteristics across work groups and organizations need to be examined, as well as the individual level of analysis.

Since Baldwin and Ford's review, researchers have begun to conceptualize the manner in which work environment factors influence the transfer of learned behaviors to the job through a construct referred to as *organizational transfer climate* or the *climate for training transfer* (Goldstein, 1993). Tannenbaum and Yukl (1992), in their review of the literature, noted the importance of a supportive organizational transfer climate but found very few empirical efforts and virtually no understanding of what constitutes an organizational transfer climate. Without first developing a valid and reliable measure of the transfer climate construct, it would seem difficult for research on the impact of the climate on transfer of training to move forward.

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Research Questions

The purpose, therefore, of this paper is to examine the empirical studies conducted since Baldwin and Ford's review to determine what progress has been made on their research recommendations and what research gaps continue to exist. The following exploratory questions framed and guided the investigation:

1. Have Baldwin and Ford's concerns about correlation-only studies, single source data, short time spans, and levels of analysis issues been addressed?
2. What work environment factors have been empirically studied? How have these factors been operationalized and measured? Which of these factors appear to be most important?
3. Have valid and reliable methods been developed to measure organizational transfer climate?

Method

Given Baldwin and Ford's call for more rigorous scientific investigation of the climate / transfer phenomenon and a desire for field tested prescriptions, the search for this review was limited to empirical studies conducted in a field setting published since 1987 and reported in refereed journals. To focus the study, only articles that examined the effect of one or more post-training climate variables on training transfer were selected for further analysis.

Results

As a result of the search, 21 empirical articles were reviewed, from which 9 were selected that clearly met the search criteria. Table 1 presents a summary of the 9 empirical studies conducted since 1987 which included analysis of the effect of transfer climate variables on post-training behaviors. It should be noted that the majority of the studies also included analysis of other independent variables, such as trainee characteristics, but these variables are not reflected in the table.

Design Problems in the Study of the Climate / Transfer Relationship An examination of Table 1 suggests there has been relatively little progress on Baldwin and Ford's 1988 recommendations and the major problems with the study of work environment noted in their review remain. Seven of the nine studies used a pre-experimental, one-shot case study or one-group pretest-posttest design, designs subject to validity problems and from which causality cannot be inferred. Only two of the studies used a control group design with random selection (Brinkerhoff & Montesino, 1995; Tziner, Haccoun, & Kadish, 1991). Tziner et al. (1991) included a variable on the work environment in their study of the effect of a relapse prevention module on the use of trained skills. However, no main effect on skills transfer was found for the work environment factor. Brinkerhoff & Montesino (1995) appear to offer the only study in which an intervention was made to change the work environment in the manner recommended by Baldwin and Ford. The independent variable was management support for training. Supervisors of trainees in the experimental group conducted fifteen minute meetings pre and post-training using a discussion checklist. Trainees who received the intervention reported significantly more transfer of training than those trainees who did not receive the before and after interventions. However, even this study had limitations, relying on self report data only and failing to establish controls to monitor or insure that the before and after briefings took place as designed.

The criterion problem of using only self-reported measures of effort to transfer also continues to be an issue. As seen in Table 1, only three of the studies attempted to collect data on transfer

Table 1. Summary of Empirical Studies (Since 1987) Which Included Analysis of the Effect of Transfer Climate Variables on Post Training Behaviors

Study	Experimental Design	Sample & Context	Transfer Climate Variables	Source For Transfer Behaviors / Timing	Findings
Brinkerhoff & Monesino (1995)	Post-test only control group design; survey w/ 5 pt scale; t-test	91 mid-managers / supervisors; pharmaceutical co.; behavioral skills courses	- Supervisor support (pre and post training discussion checklist with trainee)	Self reports / 6 weeks after training	Significant; more perceived transfer from group receiving the supervisory support intervention.
Facteau, Dobbins, Russell, Ladd, & Kudisch (1995)	One-shot case study; suvey w/ 5 pt. scale (14 constructs); LISREL VII	967 managers / supervisors; state government; those who had completed at least one course in training curriculum	- Subordinate support - Peer support - Supervisor support - Management support - Task constraints	Self reports / varied timing	Peer and subordinate support were only environment factors found to be significantly and positively related to perceived training transfer.
Ford, Quinones, Sego, & Sorra (1992)	One-shot case study; survey w/ 7 pt. scale; hierarchical regression	180 graduates from Air Force technical training program and their supervisors; aircraft maintenance - opportunity to perform trained skills (breadth, activity level, type of task)	- Supervisor attitudes and perceptions of trainee - Workgroup support - Work flow (pace)	Self reports / 4 months after training	Positive attitudes of supervisor related to performing greater number of trained tasks; positive perceptions of supervisors and supportive workgroup associated with performing more of complex tasks; work flow not significant.
Quinones, Sego, Ford, & Smith (1995)	One-shot case study; survey w/ 7 pt. scale; LISREL VII	118 graduates from Air Force technical program on equipment maintenance; opportunity to perform trained tasks	- Supervisor attitudes toward subordinate - Workgroup support	Self reports / 4 months after training	Supervisor attitudes and workgroup support found to have direct impact on opportunity to perform trained tasks the first four months on the job.
Rouiller & Goldstein (1993)	One-shot case study; surveys w/ 5 pt. scale; multiple regression	102 trainees attending 9-week assistant manager training program on admin. and management of fast food restaurants	- Situational cues - Consequences	Unit Managers and experienced crew members / evaluation of trainees after several weeks on the job	Climate variables significantly related to transfer behavior; both situational cues and consequences were each found to add significantly to the explained variance.

Table 1 (continued)

Study	Experimental Design	Sample & Context	Transfer Climate Variables	Source For Transfer Behaviors / Timing	Findings
Tesluck, Farr, Mathieu, & Vance (1995)	One-shot case study; survey w/ 5 pt. scale; self reports; 3-stage hierachical regression	252 employees, supervisors; state transp. agency; employee involvement skills; 3 levels of analysis: individual, unit, and sub-organization	- Sub-organization and unit: managers attitudes and behaviors - Sub-organization and unit: climate for participation / bottom up decision making	Self reports / timing not stated	No support for relation of managers attitudes and behaviors or climate for participation to generalization of knowledge and skills at either sub-organization or unit level.
Tracy, Tannenbaum, & Kavanagh (1995)	One group, pretest-posttest; surveys w/ 5 pt.scale; LISREL	104 suprmarket managerial trainees; supervisory skills training	- Transfer climate social and goal cues task cues no feedback punishment extrinsic reinforc. intrinsic reinforc. - Learning culture social support continuous innov. competitiveness	Self and supervisor; pre and posttraining questionnaire / 3 weeks pre and 6-8 weeks post.	Supported for both Transfer Climate and Learning Culture; all sub-scales significant; social factors exhibited highest path coef.
Tziner, Haccoun, & Kadish (1991)	Posttest only control group design;survey w/ 5 point scale; 3 x 3 x 2 ANOVA	81 military instructors (45 test, 36 control); Israeli Defense Forces; How to develop training packages; test group received additional 2 hour module on relapse prevention (RP).	Perceived work environment as supportive for transfer	Self and supervisor / 10 weeks after training	Not supported - no main effect for the work environment factor.
Xiao (1996)	One-shot case study; questionnaire with scales; hierarchical regression	106 production workers on a circuit board production line in China	- Work design - Rewards - Supervision - Peer relationships	Self reports; 9 months after training	Work design and supervision were found to be significant variables in training transfer.

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behavior from sources other than the trainee. Tracey et al. (1995) and Tziner et al (1991) included surveys of supervisors to assess transfer behavior and Rouiller and Goldstein (1993) asked managers and experienced crew members to complete a survey of behavior based on training objectives.

The collection of transfer behavior data soon after training and with limited data points continues to remain a problem. While the time periods for initial data collection in this group of studies range from 6 weeks to 4 months, no studies attempted to collect measures at multiple intervals over extended periods of time to determine the degree of skill maintenance.

Finally, only one study (Tesluck, Farr, Mathieu, & Vance, 1995) attempted to look at differences in support and other climate factors across different work groups, in this case, a state transportation agency with eleven operating suborganizations similar in size, operations, and budgets, and units within each suborganization. No relationship was found between managers attitudes and behaviors or other climate related variables and trainee generalizations of skills to the job at either the suborganization or unit level.

Work Environment Variables and Their Relative Importance Table 2 presents a matrix of the climate factors examined in the 9 empirical studies along with representative definitions. Questionnaires, designed with 5 or 7-point likert scales, were the only method of data collection.

In regard to factor importance, the most distinct pattern that seems to emerge in Table 2 is the significance of supervisor and peer support as key transfer climate factors. On the other hand, a variable of interest that appears to have had little study is the role of the subordinate in transfer. The one study that included subordinates, Facteau et al. (1995) found subordinate support to be significantly related to perceived training transfer.

Measurement of Organizational Transfer Climate In regard to organization of the variables into a meaningful model for research and measurement, there appears to be two approaches to thinking about the underlying factors. One approach seems to cluster factors into two related dimensions: one social or interpersonal in nature and the other dealing with the organizational factors that support or hinder transfer. Wexley & Latham (1991) use this approach in discussing work environment and transfer in their general training text. However, the scales developed from this perspective and used in the study of climate in the literature have generally been selected a priori from parts of previous survey efforts and do not have any reported validity or reliability statistics. The second approach, conceived by Rouiller and Goldstein (1993), based the survey scales on a behavior modification model. They sorted factors into two general categories of workplace cues, situational and consequence, each with four sub-scales (see definitions in table 2). Rouiller and Goldstein's scales were derived a priori using expert sorting judgments, not factor analysis. Tracey et al. (1995) replicated and extended Rouiller and Goldsteins work, using items drawn from their instrument along with an additional dimension of the work context called continuous learning culture. Again, a significant relationship with post-training behaviors was found for both the climate measure and the culture measure. However, their climate scales were similar but not identical to those used by Rouiller and Goldstein because they were derived from factor analytic techniques.

Even though Rouiller and Goldstein and Tracy et al.'s studies represent the most advanced work on measurement of climate factors to date, we do not seem to have enough data to determine with any degree of certainty which dimensions and corresponding scales are valid and reliable. For example, a recent study by Bates, Holton III, and Seyler (1996) failed to validate Rouiller and Goldstein's hypothesized structure of transfer climate factors. Furthermore, based on an examination of published instruments that deal with organizational climate, it appears that no "off the shelf" instrument is currently available to assess the construct of organizational transfer climate in a valid and reliable manner. Thus, it appears that further research is necessary to identify and refine the underlying factors of the climate for transfer construct and a series of validity and reliability studies across a variety of work and organizational situations need to be conducted in order to create a useful organizational transfer climate measure.

Table 2. Climate Factor Research Matrix and Definitions

	Manage-ment	Supervisor	Peers	Subordinate	Situational Cues	Conse-quences	Work Flow / Job Design	Situational Constraints	Learning Culture
Brinkerhoff / Montesino (1995)		X*							
Facteau et al (1995)	X	X	X*	X*				X	
Ford et al (1992)		X*	X*				X		
Quinones et al (1995)		X*	X*						
Rouiller & Goldstein (1993)		X*	X*		X*	X*			
Tesluck et al (1995)		X							X
Tracy et al (1995)		X*	X*		X*	X*			X*
Tziner et al (1991)		X	X					X	
Xiao (1996)		X*	X			X	X*		

* significant relationship to training transfer established

Transfer Climate Factor Definitions - Representative Examples:

Social Support: extent to which managers, supervisors, peers, and subordinates facilitate, encourage, and support learning; includes setting expectations and goals, providing opportunities to utilize new skills, tolerating mistakes, and reinforcing efforts to transfer (Facteau et al, 1995). (Columns 1-4)

Situational Cues: cues that serve to remind trainees of their training; includes goal cues, social cues, and task cues. (Rouiller & Goldstein, 1993).

Consequences: feedback that affects the further use of what has been learned; includes positive feedback, negative feedback, punishment, and no feedback (Rouiller & Goldstein, 1993).

Work Flow / Job Design: extent to which characteristics of a trainee's job allow him or her to use new skills and behaviors, such as pace of work (Ford et al, 1992).

Situational Constraints: lack of resources that inhibit use of new skills; includes information, tools, supplies, and time (Tziner et al, 1991).

Learning Culture: extent to which the company seems to value and emphasize employee learning as part of everyday work life (Tracy et al, 1995).

Recommendations

Two steps are clearly needed to further our knowledge of the climate construct and it's influence on transfer: (1) development and validation of a reliable survey instrument, and (2) studies of true empirical design which intervene to change climate variables and evaluate the impact on transfer.

Development of a Survey Instrument Glick (1985) has provided recommendations on how to develop climate specific measures that are valid and reliable. His suggestions include (1) obtaining representative samples from different types of organizations, (2) using multiple methods of data collection, such as using trained observers to supplement survey data, (3) using descriptive rather than affective questions, and (4) controlling for bias with random sampling. Good examples of the use of Glick's recommendations exist in literature for other climate referent studies (cf. Zohar, 1980; Kozlowski and Hults, 1987).

Research Designs Given a valid and reliable instrument for measure transfer climate, attention must then be paid to designing true experimental or quasi-experimental studies that address the problems related to causality, criterion, and time raised by Baldwin and Ford. For example, a pretest-postest control group design using analysis of covariance would give us relative confidence that the selected independent (treatment) climate variable was responsible for observed differences in transfer, and that differences were not due to instrumentation, history, or other sources of invalidity. In addition, repeated measures of transfer need to be conducted at least six months and one year following the training to determine long-term retention and maintenance of the behaviors.

Within the framework of better experimental designs, a number of the climate variables could be investigated. For example, since supervisor influence appears to be a significant variable in the transfer climate, a good beginning point would be to replicate Brinkerhoff and Montesino's (1995) study, which provided for a simple intervention where supervisors of trainees in the experimental group conducted brief pre- and posttraining meetings using a discussion checklist. By using the pretest-posttest control group design, providing for supervisor assessment of transfer in addition to self report data, and taking repeated measurements over time, we could reach more definitive conclusions about the impact of supervisor involvement on training transfer. Another interesting study would be to intervene at the subordinate level, providing subordinates of supervisors receiving management skills training a briefing and some coaching on how they can help their supervisors be successful in the transfer of the leadership behaviors.

Conclusion Although research has continued to be conducted, the world of knowledge in regard to the effect of post-training work environment on training transfer does not appear to have changed much since Baldwin and Ford's 1988 review. In addition, transfer of training is a complex, systemic issue. As indicated by Baldwin and Ford's model, the transfer climate is only one part of the equation. But before we can design and test a framework that incorporates the more complex interactions among the inputs of trainee characteristics, training design, and work environment, it would seem appropriate to isolate and document empirically the most important factors in each area of input. In regard to work environment, this progress review of recent research indicates that there is still much work to be done on the theoretical development and measurement of the construct now being referred to as the organizational transfer climate. The task before us is one of model building, conceptualizing the system in terms of variables and relationships that will be intellectually manageable and then rigorously examining the components of the model until we feel we have a valid representation of the real system which will provide the basis for prescriptive intervention.

The first priority, then, is the development of a valid and reliable instrument for assessing transfer climate. As noted by Bates et al. (1996), various conclusions are currently being drawn about the importance of transfer climate while using a variety of instruments of varying quality. Given an appropriate instrument, the next step to advance our knowledge of the effect of transfer climate on newly trained behaviors would be the use of more robust experimental designs to isolate and examine the various hypothesized climate factors. As noted by Baldwin and Ford

and confirmed by this progress review, conclusions from the existing research are problematic, given the relatively short-term, single-source, correlational nature of the data. It is hoped that this progress review of recent research along with the proposed model and call for stronger instrumentation and research designs will help spur further efforts at expanding our knowledge of the transfer of training process.

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